US 20040070503A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2004/0070503 A1**

Monahan (43) **Pub. Date: Apr. 15, 2004**

(54) **FLEXIBLE RFID ANTENNA PANEL AND SYSTEM**

(76) Inventor: **Brian Monahan**, Santa Cruz, CA (US)

Correspondence Address:
Ralph C. Francis
Francis Law Group
1808 Santa Clara Avenue
Alameda, CA 94501 (US)

(21) Appl. No.: **10/269,716**

(22) Filed: **Oct. 10, 2002**

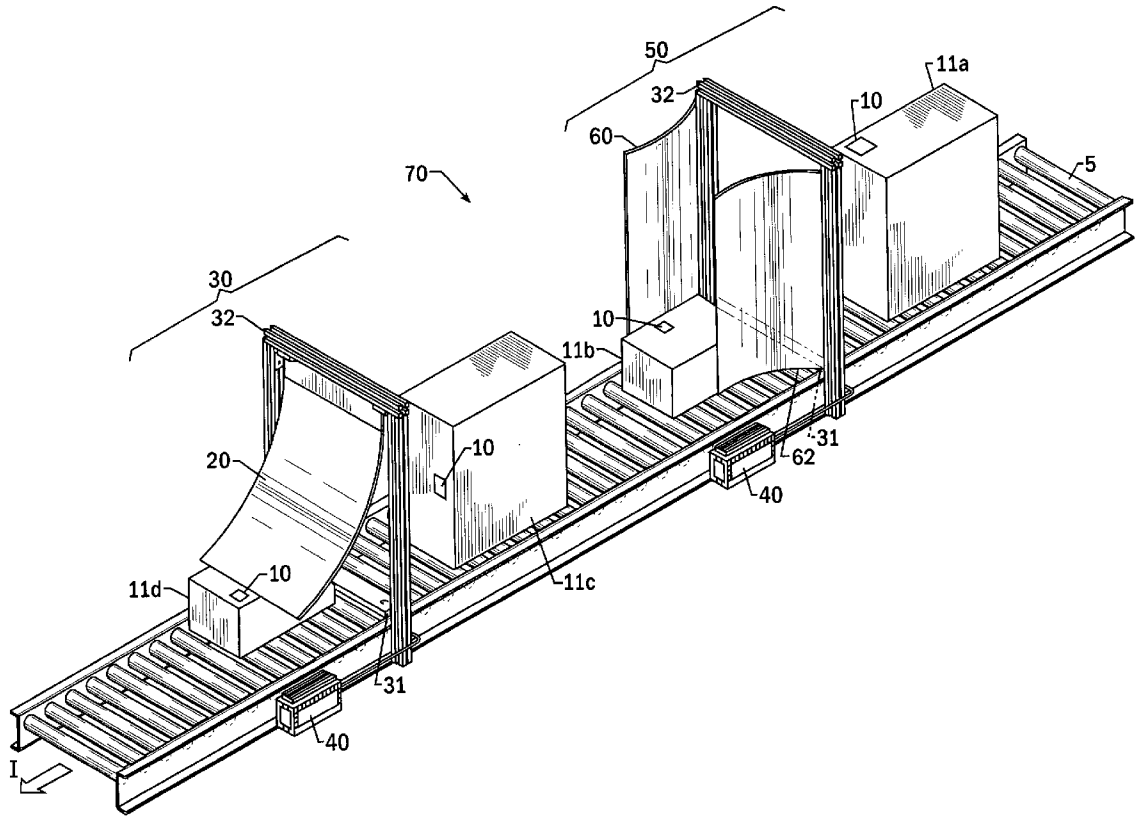
Publication Classification

(51) **Int. Cl.**[7] **G08B 13/14**

(52) **U.S. Cl.** **340/572.7**

(57) **ABSTRACT**

A RFID antenna system for communicating with at least one transponder disposed on an object (e.g., product carrier, product, etc.) moveable along an interrogation path comprising at least one antenna panel that defines an antenna region, the antenna panel including at least one substantially continuous antenna loop for transmitting and receiving electromagnetic fields, the antenna panel being oriented such that the antenna panel intersects the interrogation path. The antenna panel can be substantially flexible or rigid.



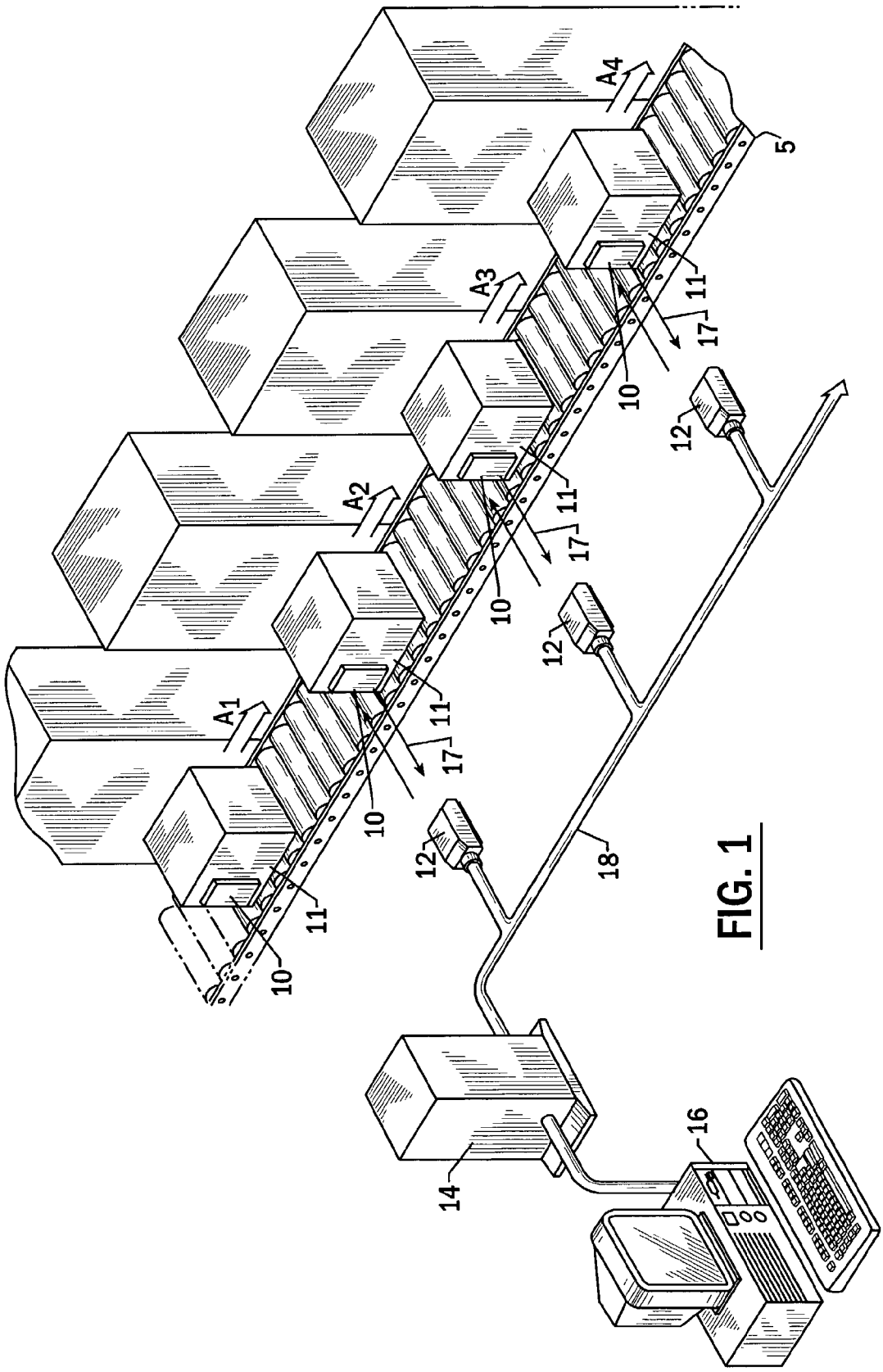


FIG. 1

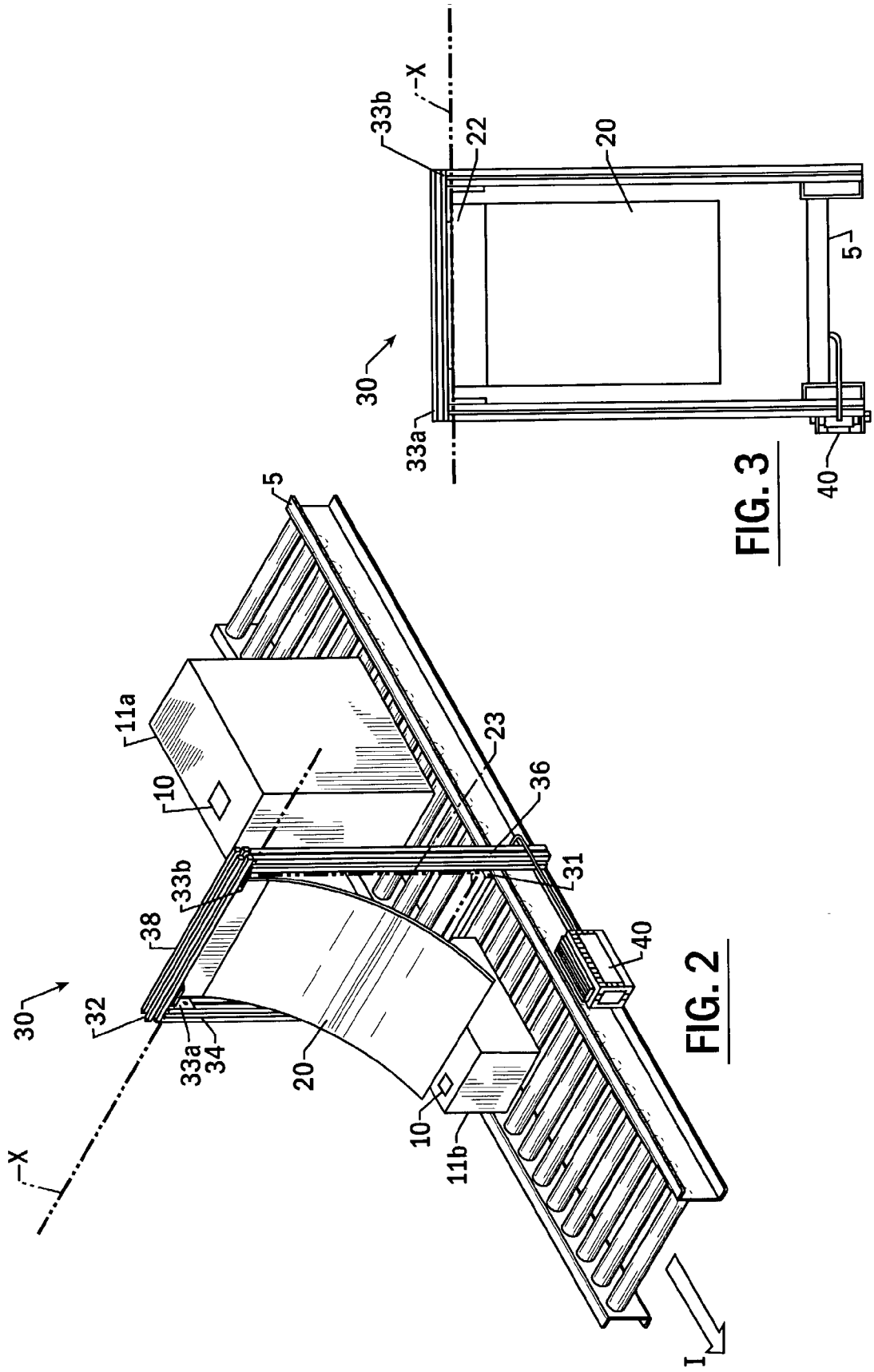


FIG. 3

FIG. 2

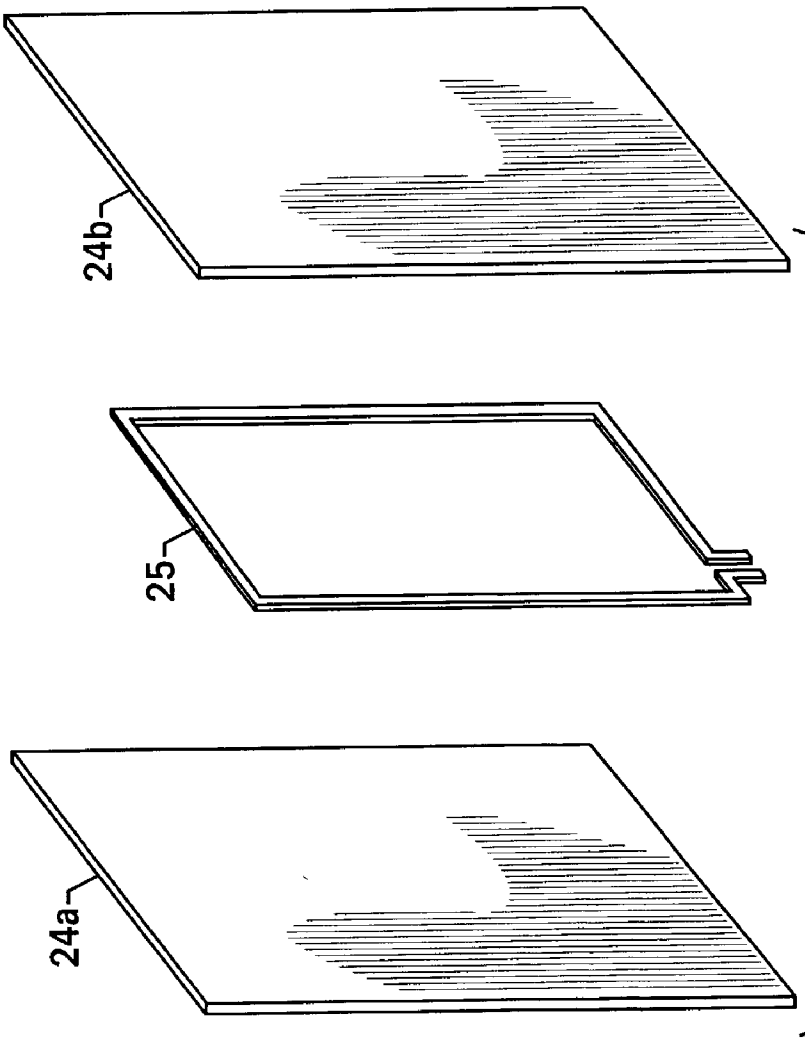


FIG. 4

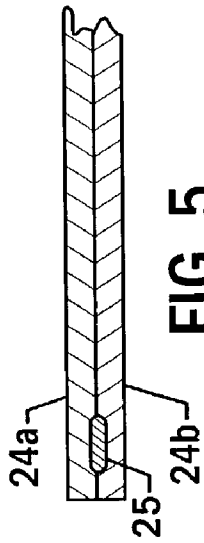


FIG. 5

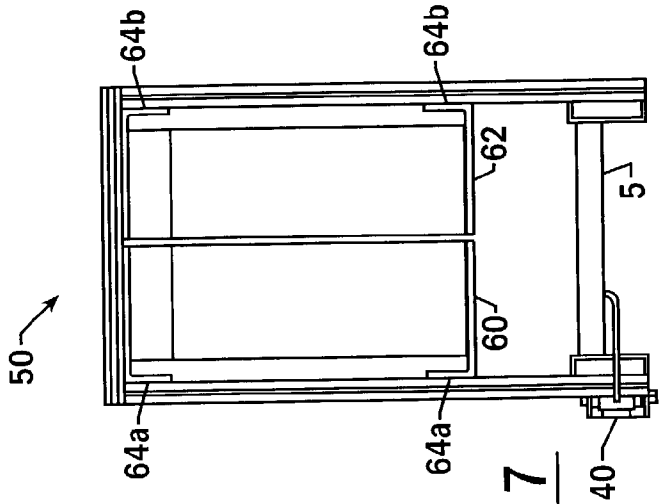

64b
64b
62
5
50
60
64a
64a
40

FIG. 7

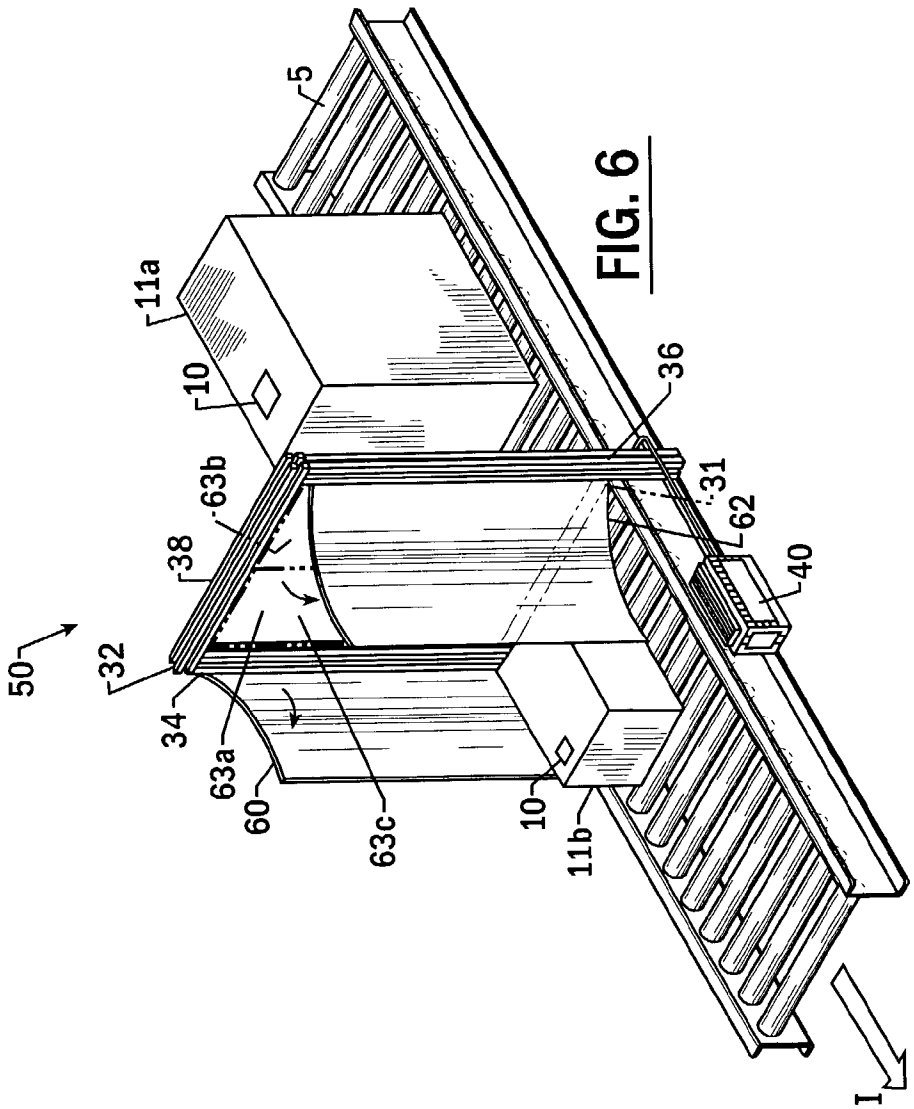

5
11a
10
36
63b
31
38
62
40
50
32
34
63a
60
63c
10
11b
I

FIG. 6

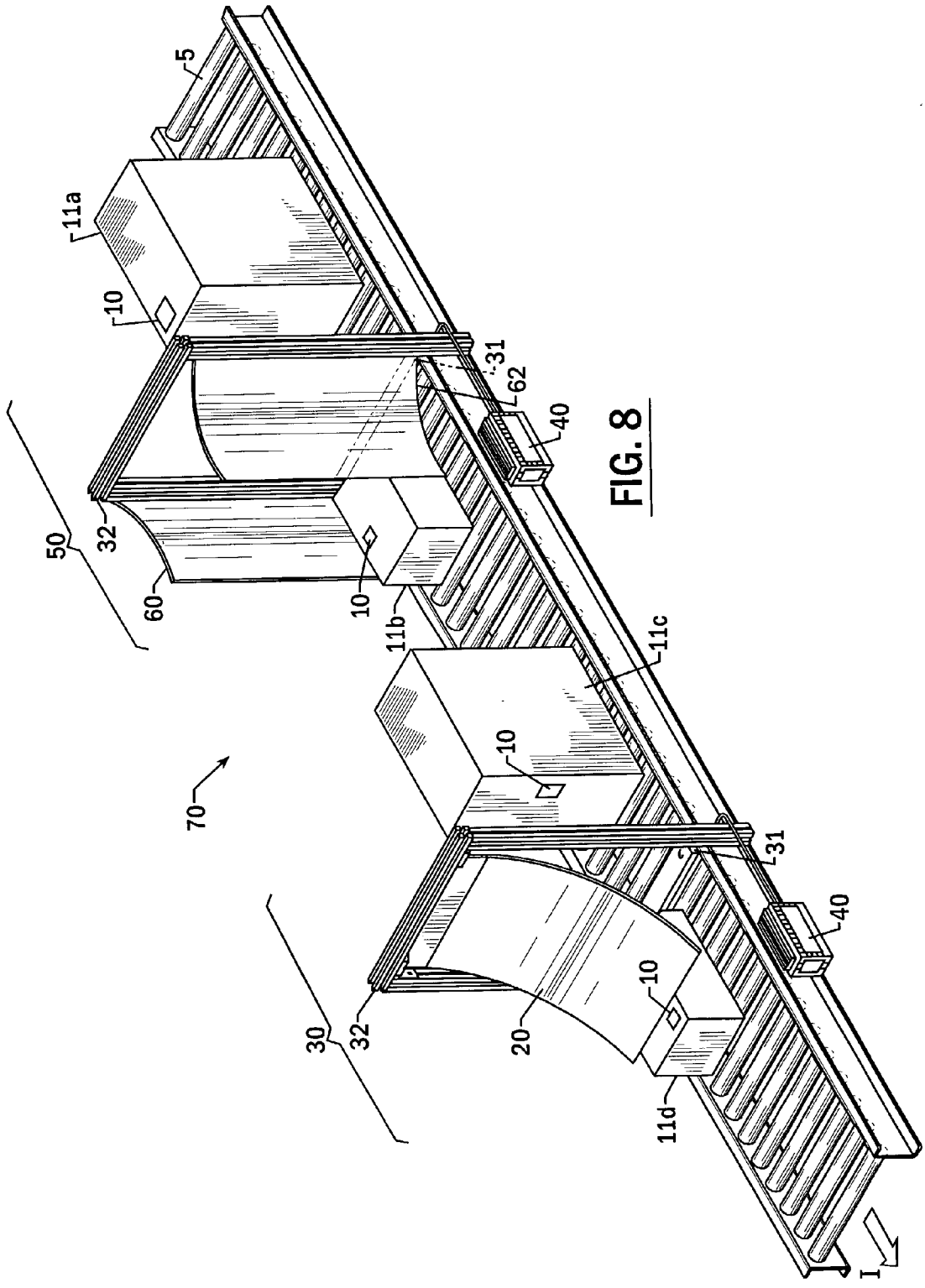


FIG. 8

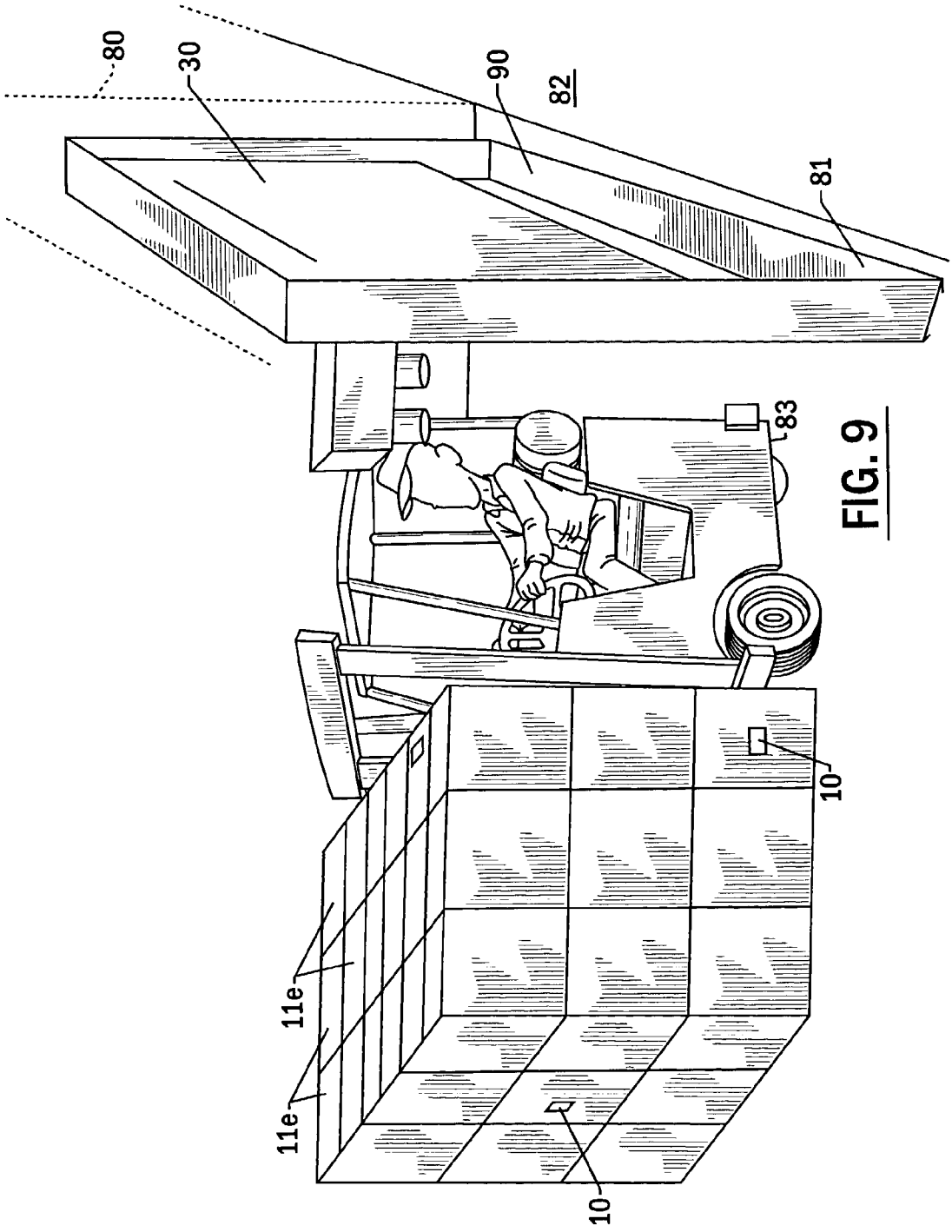


FIG. 9

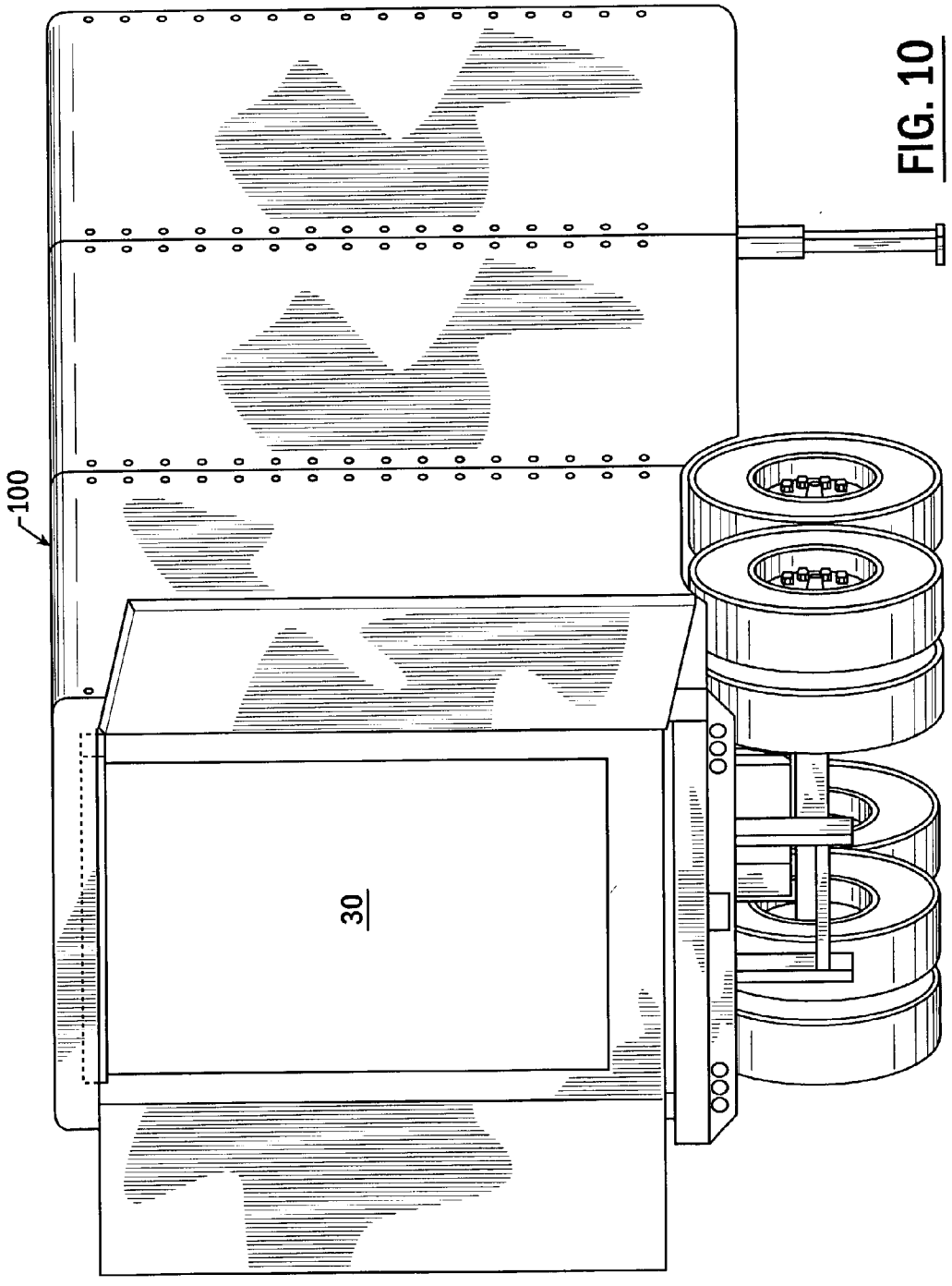


FIG. 10

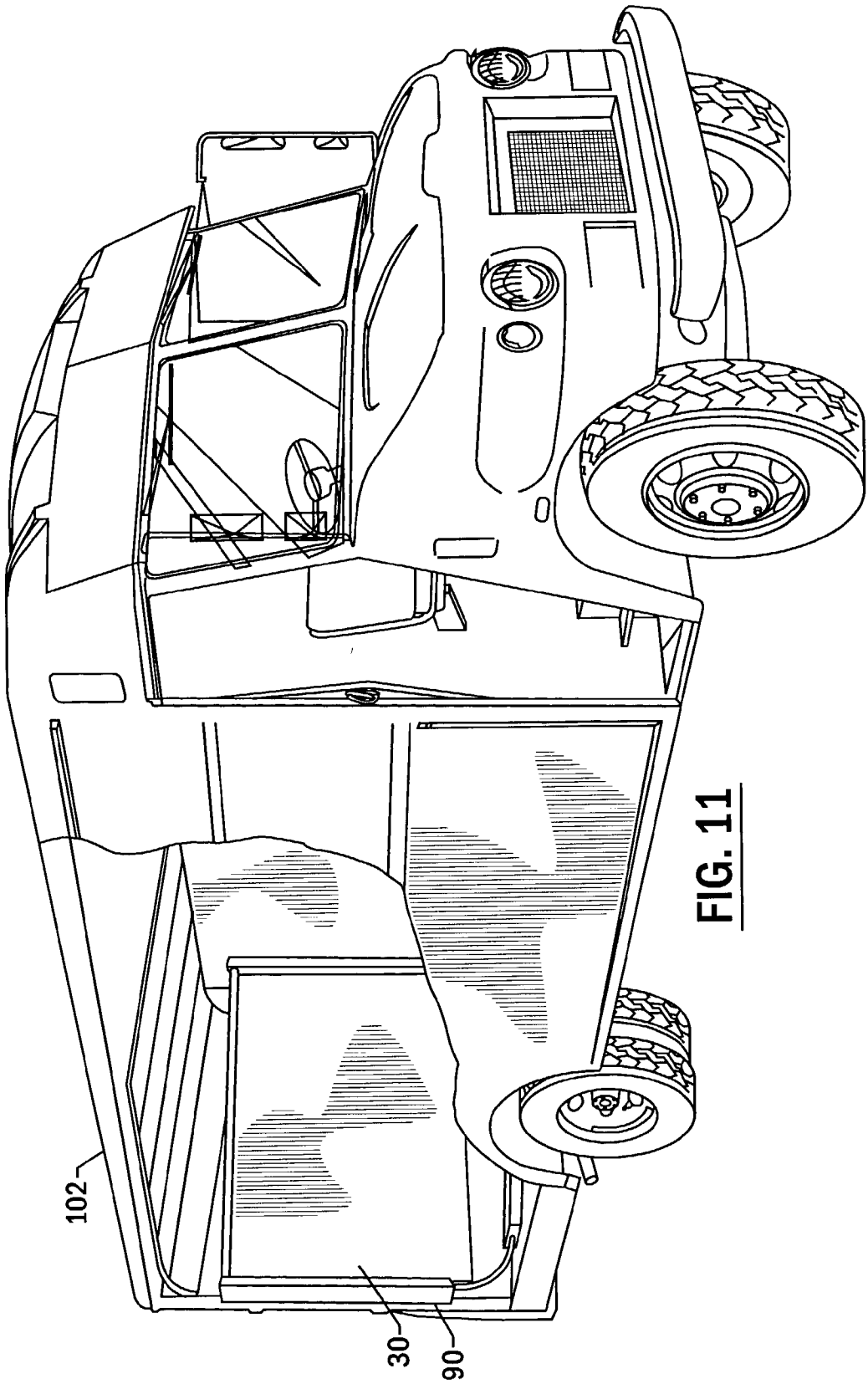


FIG. 11

FLEXIBLE RFID ANTENNA PANEL AND SYSTEM

FIELD OF THE INVENTION

[0001] The present invention relates in general to radio frequency identification (RFID) devices. More particularly, the invention relates to a flexible RFID antenna panel and system.

BACKGROUND OF THE INVENTION

[0002] RFID systems are well known in the art. Such systems include relatively large packages containing battery powered transmission/receiving circuitry, such as the identification system disclosed in U.S. Pat. No. 4,274,083, to passive systems in which the transponder receives its power from the base station or interrogator, such as the identification system disclosed in U.S. Pat. No. 4,654,658.

[0003] A typical RFID system is made up of reusable transponders or tags fixed to or embedded in product carriers, an antenna system that interrogates the tags via a RF link and a controller. The host (or computer) system interfaces with the controller and directs the interrogation of the tags.

[0004] The RFID antenna system typically employs a high frequency signal to interrogate the tags and, hence, product carriers that are moved on an interrogation path, such as a conveyor. The antenna system is generally disposed near the interrogation path to provide effective communication to and from the tags.

[0005] The location of the antenna is critical to the interrogation and receipt of the identification code and other data transmitted to and from the tags. For example, if a relatively small single antenna is employed or the antenna is positioned too far from the interrogation path, inadequate coverage of the interrogation path will occur.

[0006] Several attempts have been made to optimize the RF link and, hence, communication between the antenna and the tags. In one (typically employed) approach, a frame antenna of rectangular or square shape is fitted around the conveyor.

[0007] The noted system has several drawbacks. In particular, the antenna system exhibits one or more dead zones for certain tag positions. For example, there is a dead zone across the very center of the conventional frame antenna. If a tag is located within a window that is parallel to the conveyor belt and comprises some distance on either side of the center frame axis, and maintains this position throughout the read area of the antenna, the tag would not be read.

[0008] Moreover, the accuracy and completeness of the reading also decreases if several tags are following one another in close succession during movement along the conveyor. When tags are in close succession and relatively far from the read antenna, the tags appear to be the same distance from the read antenna and thus send back simultaneous transmissions. The result of a simultaneous transmission is an unintelligible identification code. This is particularly the case in a noisy environment, for which shielding would be necessary.

[0009] It is therefore an object of the present invention to provide a RFID antenna panel and system that overcomes the noted drawbacks associated with prior art antenna systems.

[0010] It is another object of the invention to provide an antenna system having at least one antenna panel that provides optimum coverage over the interrogation path.

[0011] It is another object of the present invention to provide a RFID antenna system that can be readily incorporated into a conveyor system to provide accurate interrogation of tags fixed to or embedded in product carriers.

[0012] It is another object of the present invention to provide a RFID antenna system that can be readily incorporated into the entrance to a building or warehouse (e.g., dock door) to provide accurate interrogation of tags fixed to or embedded in product carriers passing through the entrance.

[0013] It is yet another object of the present invention to provide a RFID antenna system that can be readily incorporated into cargo trucks or trailers to provide accurate interrogation of tags disposed on products or product carriers during loading and unloading.

SUMMARY OF THE INVENTION

[0014] In accordance with the objects and advantages of the present invention, the RFID antenna system for communicating with at least one transponder disposed on an object (e.g., product carrier, product, etc.) moveable along an interrogation path generally comprises at least one flexible antenna panel, the antenna panel defining an antenna region, the antenna panel including at least one substantially continuous antenna loop for transmitting and receiving electromagnetic fields, the antenna panel being oriented such that the antenna panel intersects the interrogation path, the antenna panel being adapted to bend about at least a first axis when the object intersects the antenna region. The antenna panel is preferably substantially planar and rectangular in shape.

[0015] In an additional embodiment of the invention, the antenna system comprises at least one substantially rigid antenna panel that similarly defines an antenna region, the antenna panel including at least one substantially continuous antenna loop for transmitting and receiving electromagnetic fields, the antenna panel being oriented such that the antenna panel intersects the interrogation path, the antenna panel being hingedly connected to at least a first hinge connection whereby the antenna panel rotates about the hinge connection when an object intersects the antenna region.

[0016] In an additional embodiment of the invention, the antenna system includes a support member; at least one antenna panel, the antenna panel defining an antenna region, the antenna panel including at least one substantially continuous antenna loop for transmitting at least a first electromagnetic field and receiving at least a second electromagnetic field, the antenna panel being attached to the support member such that the antenna panel intersects the interrogation path; and control means in communication with the antenna loop for controlling said transmittal and receipt of the first and second electromagnetic fields by the antenna loop.

[0017] In one aspect of the noted embodiment, the antenna panel is substantially flexible and adapted to bend about at least a first axis when the object intersects the antenna region. In a further aspect of the invention, the antenna panel is substantially rigid and the support member includes at

least one hinge connection that is adapted to hingedly engage the antenna panel, the antenna panel being adapted to rotate about the hinge connection when the object intersects the antenna region.

[0018] In a further embodiment of the invention, the antenna system includes a conveyor system adapted to transport at least one of the objects along the interrogation path.

[0019] In an additional embodiment, the antenna system includes a conveyor antenna disposed proximate the interrogation path. The conveyor antenna is adapted to transmit at least a third electromagnetic field and receive at least a fourth electromagnetic field, the third and fourth electromagnetic fields being directed substantially perpendicular to the interrogation path.

[0020] In yet another embodiment of the invention, the antenna system comprises a support system having a first substantially vertical support member and a second substantially vertical support member; first and second antenna panels, the first antenna panel including at least a first substantially continuous antenna loop for transmitting at least a first electromagnetic field and receiving at least a second electromagnetic field, the second antenna panel including at least a second substantially continuous antenna loop for transmitting at least a third electromagnetic field and receiving at least a fourth electromagnetic field; the first and second antenna panels being substantially rectangular in shape and including first and second vertical edge regions, the first antenna panel first vertical region being engaged to the first vertical support member and the second antenna first vertical region being engaged to the second vertical support member, whereby the first and second antenna panels define an antenna region, the antenna region intersecting the interrogation path.

[0021] In one aspect of the noted embodiment, the first and second antenna panels are substantially flexible. The first flexible antenna panel is rigidly engaged to the first vertical support member and the second flexible antenna panel is rigidly engaged to the second vertical support member, the first flexible antenna panel being adapted to bend about at least a first axis when an object intersects the antenna region and the second flexible antenna panel being adapted to bend about at least a second axis when an object intersects the antenna region.

[0022] In a further aspect of the invention, the first and second antenna panels are substantially rigid. The first rigid antenna panel is hingedly connected to the first vertical support member and the second rigid antenna panel is hingedly connected to the second vertical support member, the first and second rigid antenna panels being adapted to rotate about the hinge connections when an object intersects the antenna region.

[0023] In a further aspect of the noted embodiment, the antenna system similarly includes a conveyor antenna disposed proximate the interrogation path, the conveyor antenna being adapted to transmit at least a fifth electromagnetic field and receive at least a sixth electromagnetic field, the fifth and sixth electromagnetic fields intersecting the interrogation path.

[0024] In a further embodiment of the invention, the RFID antenna system comprises at least one antenna panel system (as described herein) disposed in the entrance to a building, the antenna panel, if flexible, being adapted to bend about a first axis when an object passes through the building entrance or, if rigid, rotate about a hinge connection when an object passes through the building entrance.

[0025] In yet a further embodiment of the invention, the RFID antenna system comprises at least one antenna panel system (as described herein) disposed in the entrance to a transport vehicle (e.g., cargo truck, trailer), the antenna panel, if flexible, being adapted to bend about a first axis when an object passes through the entrance or, if rigid, rotate about a hinge connection when an object passes through the entrance.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] Further features and advantages will become apparent from the following and more particular description of the preferred embodiments of the invention, as illustrated in the accompanying drawings, and in which like referenced characters generally refer to the same parts or elements throughout the views, and in which:

[0027] **FIG. 1** is a schematic illustration of a typical RFID system;

[0028] **FIG. 2** is a perspective view of one embodiment of the flexible RFID antenna system, according to the invention;

[0029] **FIG. 3** is a front plan view of the RFID antenna system shown in **FIG. 2**;

[0030] **FIG. 4** is an exploded perspective view of one embodiment of the flexible RFID antenna panel, according to the invention;

[0031] **FIG. 5** is a partial section view of the antenna panel shown in **FIG. 4**;

[0032] **FIG. 6** is a perspective view of a further embodiment of a RFID antenna system employing two flexible antenna panels, according to the invention;

[0033] **FIG. 7** is a front plan view of the RFID antenna system shown in **FIG. 6**;

[0034] **FIG. 8** is a perspective view of a further embodiment of a RFID antenna system employing two RFID antenna subsystems, according to the invention;

[0035] **FIG. 9** is a schematic illustration of a flexible RFID antenna system incorporated into a building entrance, according to the invention;

[0036] **FIG. 10** is a schematic illustration of a flexible RFID antenna system retrofitted into a trailer, according to the invention; and

[0037] **FIG. 11** is a schematic illustration of a flexible RFID antenna system retrofitted into a cargo truck, according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0038] The RFID antenna of the present invention substantially reduces or eliminates the disadvantages and shortcomings associated with prior art antenna systems. According to one embodiment of the invention, a flexible antenna

panel is disposed proximate the interrogation path for interrogating transponders disposed on objects moving along the interrogation path. The antenna panel is preferably oriented such that the plane defined the antenna panel intersects the interrogation path. As discussed in detail below, the antenna panel is further adapted to bend about at least a first axis when an object (with a transponder thereon) intersects the plane defined by the panel.

[0039] Referring first to **FIG. 1**, there is shown a simple read/write RFID system. The system typically comprises one or more transponder or tags **10**, at least one antenna **12** to communicate with the tags **10**, and a controller **14** for managing the communications interface. The host system (i.e., computer) **16** interfaces with the controller **14** and directs the interrogation of the tags **10** disposed on or embedded in the product carriers **11** and any following action via parallel, serial or bus communications **18**.

[0040] As illustrated in **FIG. 1**, each antenna **12** is disposed on one side of the interrogation path, denoted by Arrows A_1-A_4, which is defined by the conveyor **5**. As such, the RF link **17** and, hence, active RF zone is limited. By the term "active RF zone", as used herein, it is meant to mean the zone defined by the effective RF radiation or electromagnetic field component.

[0041] Referring now to **FIGS. 2 and 3**, there is shown one embodiment of the RFID antenna system **30** of the invention. A key feature of the present invention is the capability of the antenna system **30** to be positioned proximate to or incorporated into a conveyor system **5**. As illustrated in **FIG. 2**, in one embodiment of the invention the antenna system **30** is disposed proximate the interrogation path of the conveyor system **5**, denoted by Arrow I, for interrogating the tags **10** and, hence, products or product carriers **11***a*, **11***b*, moving along the interrogation path. As will be appreciated by one having ordinary skill in the art and discussed herein, the antenna panels of the invention can also be secured (hingedly or rigidly) to a ceiling above the interrogation path.

[0042] Referring now to **FIG. 2**, in one embodiment, the antenna system **30** includes (i) a conveyor system **5** adapted to move the product carriers **11***a*, **11***b* (or products) with tags **10** disposed thereon along the interrogation path (denoted by Arrow I) that is, in this instance, defined by the conveyor system **5**, (ii) an antenna support **32** having at least first and second side supports **34**, **36** and a top member **38** attachable to the side supports **34**, **36**, (iii) at least one antenna panel **20** having at least one antenna loop **25** (see **FIG. 4**) adapted to transmit and receive electromagnetic fields (i.e., provide an active RF zone), and (iv) an antenna head assembly (i.e., reader/writer) **40**.

[0043] According to the invention, the antenna panel **20** can be constructed of substantially rigid or flexible material. In a preferred embodiment of the invention, the antenna panel **20** is substantially flexible.

[0044] As further illustrated in **FIG. 2**, the antenna system **30** can, if desired, include a RFID conveyor antenna **31** to further enhance the active RF zone provided by the system **30**. Details of the noted RFID conveyor antenna are set forth in U.S. Pat. No. 5,929,760, which is incorporated by reference herein.

[0045] As discussed in detail in U.S Pat. No. 5,929,760, the conveyor antenna **31** is preferably disposed proximate an interrogation path and is positioned (and adapted) to transmit and receive electromagnetic fields (and, hence provide a further active RF zone) that intersect the interrogation path. Preferably, the electromagnetic fields provided by the conveyor antenna **31** substantially intersect the interrogation path.

[0046] Referring now to **FIG. 3**, the antenna support **32** includes at least one, preferably two antenna panel connectors **33***a*, **33***b* adapted to engage and connect the top portion **22** of the flexible antenna panel **20** to the top antenna support member **38** such that (i) the plane defined by the panel **20** (shown in phantom and denoted **23**) intersects the interrogation path (and, hence, defines an antenna region) and (ii) the flexible antenna panel **20** is allowed to bend about at least one panel axis (denoted X) disposed proximate the top portion **22** thereof when a product carrier **11***a*, **11***b* (or product) intersects the plane **23** (or antenna region) defined by the panel **20**. In a preferred embodiment, the antenna panel **20** is disposed substantially perpendicular to and intersects the interrogation path.

[0047] As illustrated in **FIG. 2**, by virtue of the flexible material employed to construct the panel **20** (discussed in detail below), the panel **20** is also adapted to bend about its body to accommodate a multitude of different size and shape product carriers **11***a*, **11***b* (and products).

[0048] According to the invention, the antenna support **32** can comprise various lightweight materials, such acrylonitrile butadiene-styrene (ABS), polycarbonate, or polyvinyl chloride (PVC). The support **32** material must, however, provide minimal interference and/or restriction of the antenna RF radiation or electromagnetic field.

[0049] In an additional envisioned embodiment of the invention, not shown, the panel connectors comprise conventional hinge connectors that are adapted to hingedly engage the antenna panel **20**. In this embodiment, the antenna panels **20** can be either substantially flexible or rigid, preferably, substantially rigid, and would rotate (i.e., swing open) when a product carrier (e.g., **11***a*) intersects the plane defined by the panel **20**.

[0050] As will be appreciated by one having ordinary skill in the art, the hinge connectors can be attached to an antenna support, such as support member **38** shown in **FIG. 2**, the ceiling above the conveyor system **5**, the top of an entrance to a building (e.g., header), such as illustrated in **FIG. 9**, or the top of the entrance (or ceiling) of a transport vehicle, such as the cargo truck and trailer illustrated in **FIGS. 10 and 11**.

[0051] Referring back to **FIG. 2**, the antenna head assembly **40**, which includes the antenna logic and associated circuitry for the antenna system **30**, is operatively connected to the antenna panel **20** and conveyor antenna **31**. Preferably, the head assembly **40** comprises a LRP**820** Reader/Writer. The noted device is manufactured and distributed by Escort Memory Systems, Scotts Valley, Calif.

[0052] In one embodiment of the invention, the antenna panel **20** and conveyor antenna **31** are designed and adapted to provide 100-ohms of impedance and are connected in parallel to achieve a 50-ohm load. In an alternative embodiment, a power splitter is employed.

[0053] Because of the close proximity that the antenna system **30** provides, read range is not critical and a smaller

tag **10** can be used. Single or multiple tag commands can thus be sent to the head assembly **40** and both antennas **20**, **31** will read either the tag **10** placed on the top of the carrier or carriers **11***a*, **11***b* or a tag placed on the bottom (not shown).

[**0054**] As will be appreciated by one having ordinary skill in the art, since the RFID antenna systems of the present invention include all the circuitry necessary to convert the digital signals received from a controller to high speed RF signals for the transponder tags, and conversely to convert the RF signals from the tags back into digital signals for the controller, numerous controllers can be employed with the antenna panel **20** and conveyor antenna **31**.

[**0055**] Referring now to **FIGS. 4 and 5**, the flexible antenna panel **20** of the invention will be described in detail. Referring first to **FIG. 4**, in one embodiment of the invention, the panel **20** includes first and second substantially flexible panel members **24***a*, **24***b* and at least one antenna loop (or circuit) **25**. In a further embodiment of the invention, the panel members **24***a*, **24***b* are constructed of a substantially rigid material. According to the invention, the antenna loop **25** is adapted to provide an effective RF zone, more preferably transmit at least a first electromagnetic field and receive at least a second electromagnetic field.

[**0056**] Referring to **FIG. 5**, in one embodiment, the panel members **24***a*, **24***b* are substantially planar and are preferably laminated together by conventional means with the antenna loop **25** disposed therebetween. In additional envisioned embodiments, one panel member (e.g., **24***a*) having at least one antenna loop or circuit disposed on at least one surface thereof is employed.

[**0057**] As will be appreciated by one having ordinary skill in the art, the panel members **24***a*, **24***b* can comprise various shapes (e.g., square, oblong, semi-circular, etc.) and dimensions, and be constructed of various flexible or rigid materials. Preferably, the panel members **24***a*, **24***b* are substantially planar, substantially rectangular in shape and constructed of commercial grade Neoprene™.

[**0058**] It will be further appreciated by one having skill in the art, that the panel member(s) material and thickness thereof should be selected to provide the least resistance to the product carrier's movement along the interrogation path.

[**0059**] Referring now to **FIGS. 6 and 7**, there is shown an additional embodiment of the antenna system, designated **50**. In the noted embodiment, at least two flexible antenna panels **60**, **62** and, if desired, the antenna conveyor **31** are employed.

[**0060**] In one embodiment of the invention, each panel **60**, **62** is hingedly connected to the first and second side supports **34**, **36** by conventional means. The panels **60**, **62** are preferably oriented such that the planes defined by the panels **60**, **62** (shown in phantom and designated **63***a*, **63***b*, respectively) are substantially perpendicular to and preferably intersect the interrogation path. In a preferred embodiment of the invention, the planes **63***a*, **63***b* are substantially coincident and, hence, define an antenna region **63***c*.

[**0061**] As illustrated in **FIG. 6**, the antenna panels **60**, **62** are further adapted to rotate about the hinge connections **64***a*, **64***b* when a product carrier **11***a*, **11***b* or product intersects the planes **63***a* and **63***b* defined by the panels **60**, **62**. As will be appreciated by one having ordinary skill in the art, in the noted "hinge connection" embodiment, the panel members **24***a*, **24***b* shown in **FIG. 4** can be constructed of a substantially flexible material or a substantially rigid material, such as ABS.

[**0062**] According to the invention, each hinge connection **64***a*, **64***b* includes conventional biasing means to provide an adjustable closing force (or moment) to the hinge connections **64***a*, **64***b* and, hence, panels **60**, **62**.

[**0063**] In an additional envisioned embodiment (not shown), the panels **60**, **62** are rigidly connected to the side supports **34**, **36** via panel connectors similar to the panel connectors **33***a*, **33***b* shown in **FIG. 2**. In this embodiment, the antenna panels **60**, **62** would be constructed of a substantially flexible material and, hence, bend upon contact with a product carrier or carriers (e.g., **11***a*, **11***b*) providing a path therebetween.

[**0064**] In a further envisioned embodiment of the invention (not shown), the antenna system **50** shown in **FIG. 6**, includes an upper panel, such as antenna panel **20** shown in **FIG. 2**. According to the invention, the upper antenna panel can be substantially flexible or rigid. In this embodiment, the upper antenna panel would similarly be connected to the top antenna support member **38** or ceiling above the antenna system **5** and adapted to bend or rotate (depending on the antenna panel material) open upon contact with a product carrier (e.g., **11***a*).

[**0065**] Referring now to **FIG. 8**, there is shown yet another embodiment of the RFID antenna system **70** of the invention. As illustrated in **FIG. 8**, the antenna system **70** employs the single and dual panel antenna systems **30**, **50**, as described above.

[**0066**] According to the invention, the antenna systems **30**, **50** can be disposed on or incorporated into the conveyor system **5** in any order, proximate to each other or at a substantial distance apart. Further, a single antenna head assembly **40** or multiple head assemblies can be employed.

[**0067**] Referring now to **FIG. 9**, there is shown yet another embodiment of the invention wherein the antenna system **30** of the invention is disposed proximate the entrance **81** to a building or warehouse **80**. As will be appreciated by one having ordinary skill in the art, the illustrated antenna system **30** ensures that a RFID tagged carriers **11***e* and/or items will be interrogated and tracked whenever they leave or enter the building **80**. The system **30** also facilitates tracking of RFID tagged carriers **11***e* and items when they are stored on a loading dock **82**, for example, prior to warehousing or loading onto a transport device **83**.

[**0068**] Alternatively, antenna system **50** shown in **FIGS. 6 and 7** can be incorporated into the building entrance **81**. Antenna system **50** would similarly facilitate tracking of tagged carriers **11***e* and items that are transported through the building entrance **81**.

[**0069**] The antenna systems **30**, **50** can also be employed with a modular RFID antenna system **90** disposed at the building entrance **81** to enhance the active RF zone. Details of the modular antenna system **90** are set forth in Co-Pending application Ser. No. 09/925,129, filed Aug. 8, 2001, which is incorporated by reference herein.

[0070] Referring now to **FIG. 10**, there is shown an additional embodiment of the invention wherein the RFID antenna system **30** of the invention is retrofitted into a trailer **100**. In a preferred embodiment, the antenna system **30** includes a modular antenna system **90** that are powered by external battery (not shown). In an additional envisioned embodiment of the invention, the antenna systems **30**, **90** are powered by the electrical or battery system of the tractor-trailer.

[0071] Referring now to **FIG. 11**, the RFID antenna system **30** of the invention can also be retrofitted into a cargo truck **102**, with a modular antenna system **90** or without. In this embodiment, the antenna system **30** is preferably powered by an existing vehicle battery.

[0072] In the embodiments shown in **FIGS. 10 and 11**, the antenna system **30** communicates with tagged items (product carriers **11**, products, etc.) as they are loaded to and unloaded from the trailer **100** or truck **102**, allowing accurate tracking of the tagged items throughout the transport chain. In addition to trailers or trucks, the system can be used with any suitable transport vehicle.

[0073] While preferred embodiments and their technical advantages have been described in the above detailed description and illustrated in the drawings, the present invention is not limited thereto but only by the scope and spirit of the appended claims.

What is claimed is:

1. A RFID antenna system for communicating with at least one transponder disposed on an object moveable along an interrogation path, comprising:

at least one flexible antenna panel, said antenna panel defining an antenna region, said antenna panel including at least one substantially continuous antenna loop for transmitting and receiving electromagnetic fields,

said antenna panel being oriented such that said antenna panel intersects said interrogation path,

said antenna panel being adapted to bend about at least a first axis when said object intersects said antenna region.

2. The antenna system of claim 1, wherein said antenna panel is disposed substantially perpendicular to said interrogation path.

3. The antenna system of claim 1, wherein said antenna panel is substantially planar.

4. The antenna system of claim 1, wherein said antenna panel is substantially rectangular in shape.

5. The antenna system of claim 4, wherein said antenna panel includes a substantially continuous edge region.

6. The antenna system of claim 5, wherein said antenna loop is disposed proximate said edge region.

7. The antenna system of claim 1, wherein said antenna panel is constructed of Neoprene™.

8. A RFID antenna system for communicating with at least one transponder disposed on an object moveable along an interrogation path, comprising:

at least one substantially rigid antenna panel, said antenna panel defining an antenna region, said antenna panel including at least one substantially continuous antenna loop for transmitting and receiving electromagnetic fields,

said antenna panel being oriented such that said antenna panel intersects said interrogation path,

said antenna panel being hingedly connected to at least a first hinge connector whereby said antenna panel rotates about said hinge connection when said object intersects said antenna region.

9. The antenna system of claim 8, wherein said antenna panel is disposed substantially perpendicular to said interrogation path.

10. The antenna system of claim 8, wherein said antenna panel is substantially planar.

11. The antenna system of claim 8, wherein said antenna panel is substantially rectangular in shape.

12. The antenna system of claim 11, wherein said antenna panel includes a substantially continuous edge region.

13. The antenna system of claim 12, wherein said antenna loop is disposed proximate said edge region.

14. A RFID antenna system for communicating with at least one transponder disposed on an object moveable along an interrogation path, comprising:

a support member;

at least one antenna panel, said antenna panel defining an antenna region, said antenna panel including at least one substantially continuous antenna loop for transmitting at least a first electromagnetic field and receiving at least a second electromagnetic field, said antenna panel being attached to said support member such that said antenna panel intersects said interrogation path; and

control means in communication with said antenna loop for controlling said transmittal and receipt of said first and second electromagnetic fields by said antenna loop.

15. The antenna system of claim 14, wherein said antenna system includes a conveyor system adapted to transport at least one of said objects along said interrogation path.

16. The antenna system of claim 14, wherein said antenna panel is disposed substantially perpendicular to said interrogation path.

17. The antenna system of claim 14, wherein said antenna panel is substantially flexible.

18. The antenna system of claim 17, wherein said antenna panel is substantially planar.

19. The antenna system of claim 17, wherein said antenna panel is substantially rectangular in shape.

20. The antenna system of claim 17, wherein said antenna panel is adapted to bend about at least a first axis when said object intersects said antenna region.

21. The antenna system of claim 14, wherein said support member includes at least one hinge connection, said hinge connection being adapted to hingedly engage said antenna panel.

22. The antenna system of claim 21, wherein said antenna panel is substantially rigid.

23. The antenna system of claim 22, wherein said antenna panel is substantially planar.

24. The antenna system of claim 22, wherein said antenna panel is substantially rectangular in shape.

25. The antenna system of claim 22, wherein said antenna panel is adapted to rotate about said hinge connection when said object intersects said antenna region.

26. The antenna system of claim 14, wherein said antenna system includes a conveyor antenna disposed proximate said

interrogation path, said conveyor antenna being adapted to transmit at least a third electromagnetic field and receive at least a fourth electromagnetic field, said third and fourth electromagnetic fields intersecting said interrogation path.

27. A RFID antenna system for communicating with at least one transponder disposed on an object moveable along an interrogation path, comprising:

a support system having a first substantially vertical support member and a second substantially vertical support member;

first and second antenna panels, said first antenna panel including at least a first substantially continuous antenna loop for transmitting at least a first electromagnetic field and receiving at least a second electromagnetic field, said second antenna panel including at least a second substantially continuous antenna loop for transmitting at least a third electromagnetic field and receiving at least a fourth electromagnetic field;

said first and second antenna panels being substantially rectangular in shape and including first and second vertical edge regions,

said first antenna panel first vertical region being engaged to said first vertical support member and said second antenna first vertical region being engaged to said second vertical support member, whereby said first and second antenna panels define an antenna region,

said antenna region intersecting said interrogation path.

28. The antenna system of claim 27, wherein said first and second antenna panels are substantially flexible.

29. The antenna system of claim 27, wherein said first and second antenna panels are substantially rigid.

30. The antenna system of claim 28, wherein said first antenna panel is rigidly engaged to said first vertical support member and said second antenna panel is rigidly engaged to said second vertical support member.

31. The antenna system of claim 30, wherein said first antenna panel is adapted to bend about at least a first axis when said object intersects said antenna region and said second antenna panel is adapted to bend about at least a second axis when said object intersects said antenna region.

32. The antenna system of claim 31, wherein said second axis is substantially parallel to said first axis.

33. The antenna system of claim 29, wherein said first antenna panel is hingedly engaged to said first vertical support member and said second antenna panel is hingedly engaged to said second vertical support member.

34. The antenna system of claim 27, wherein said first and second antenna panels are oriented such that said first antenna panel second vertical region is disposed proximate said second panel second vertical region and is substantially parallel thereto.

35. The antenna system of claim 27, wherein said antenna system includes control means in communication with said first and second antenna loops for controlling said transmittal and receipt of said first, second, third and fourth electromagnetic fields.

36. The antenna system of claim 27, wherein said antenna system includes a conveyor system adapted to transport at least one of said objects along said interrogation path.

37. The antenna system of claim 27, wherein said antenna system includes a conveyor antenna disposed proximate said interrogation path, said conveyor antenna being adapted to transmit at least a fifth electromagnetic field and receive at least a sixth electromagnetic field, said fifth and sixth electromagnetic fields intersecting said interrogation path.

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